Abstract Submitted
to the EPA Niagara Falls Meeting
October 22, 2003

Microbial Research in a TCE – Contaminated Saturated Competent Bedrock Site

N.E. Kinner*, T. Eighmy, L.S. Tisa, E. Sullivan, J. Coulburn, M. Mills, K. Newman, J.C.M. Spear, W. Naser, S.G. Acinas, A. Mumford, and E.C. Griffiths

Bedrock Bioremediation Center; University of New Hampshire; Durham, NH

The University of New Hampshire's Bedrock Bioremediation Center (BBC) is conducting research at Site 32 of the Pease International Tradeport (Portsmouth, NH). The bedrock is tightly-folded, biotite-grade metasandstone and metashale of the Kittery Formation crosscut by numerous porphryitic diabase dikes. The plume in the competent rock is predominately comprised of cis-DCE (100-700 ug/L) with lesser amounts of TCE and VC. The BBC's microbial research at the site has focused on prokaryotic community profiling; spectroscopic, microbial and geochemical investigations of microfracture surfaces; protistan monitoring; and evaluations of microbial contamination during drilling. Based on DGGE of PCR-amplified DNA encoding 16S rRNA and Fluorescent In Situ Hybridization (FISH), the prokaryotic communities associated with the fracture surfaces and in the groundwater are fairly different. Several groups have been found including dehalorespirers, sulfate and iron reducing bacteria, and Archaea. Protists, primarily small nanoflagellates, have also been found and their numbers correlate to bacterial (acridine orange direct count) abundances and DOC suggesting a predator-prey relationship exists in the contaminated bedrock environment. The microfractures within the rock contain several secondary minerals including chlorite, clinoptilolite, calcite and pyrite. Bacteria are clustered in patches, primarily in crevices, on the fracture surfaces. The rock surfaces contain surface-associated chlorinated solvents and NOM that are related to the location of the adherent bacteria. Tracer studies with rhodamine, carboxylated microspheres (bacterial analogs), and ice nucleating active bacteria (INA) indicated that microbial contamination from the overlying formation is minimal for all cores taken after the first one in the competent rock, if a telescoping casing is used. The porewater collected with a core is primarily drilling fluid unless the fractures being examined are partially mineralized (i.e., well closed), because they allow little water penetration. The implications of all of these findings on management of the plume will be discussed.

* Author presenting paper.